International Institute for Applied Systems Analysis
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science for global insight

IIASA’s Water Futures and Solutions Initiative

Opportunities for African Lake and River Basin Organisations

<u>AMCOW, RECs and L/RBOs Workshop</u>

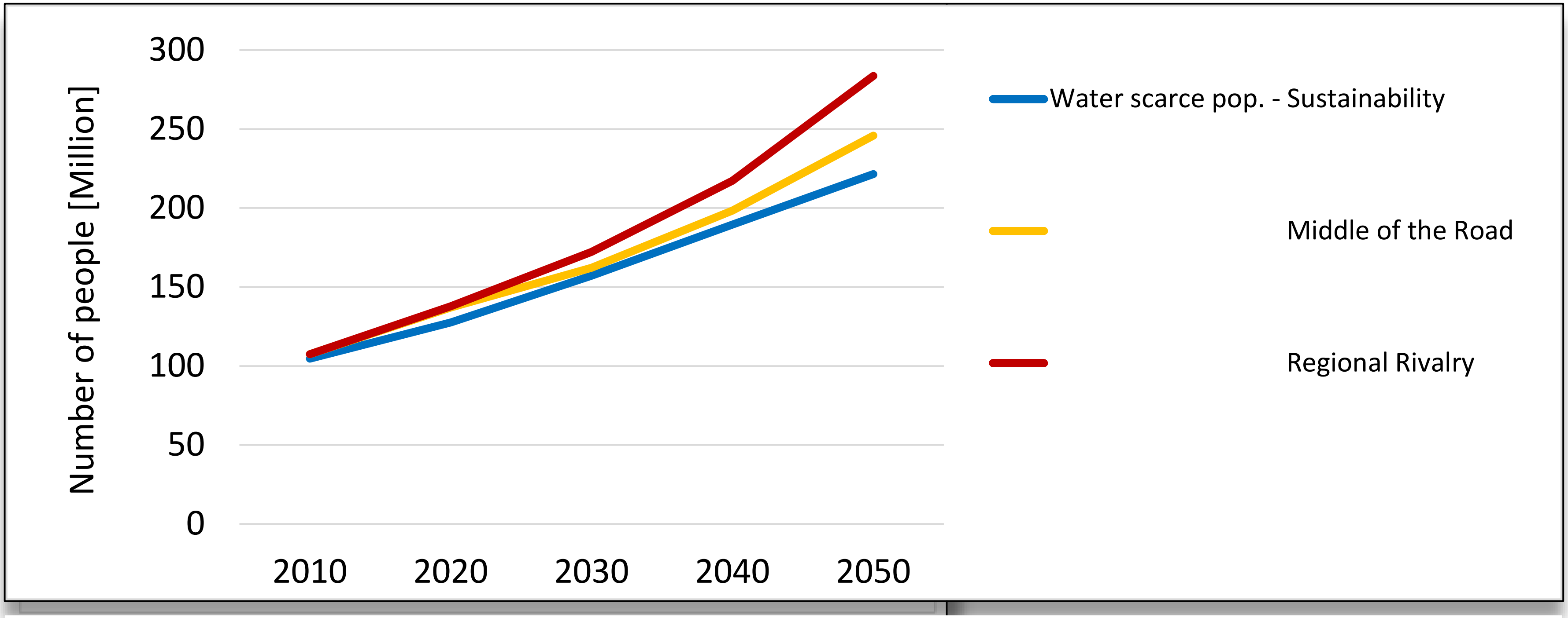
Simon Langan, Director

Robert Burtscher, Stakeholder Engagement and Liaison

Dar es Salaam, 26-27 July 2017

Potential population exposed to severe water scarcity

Africa

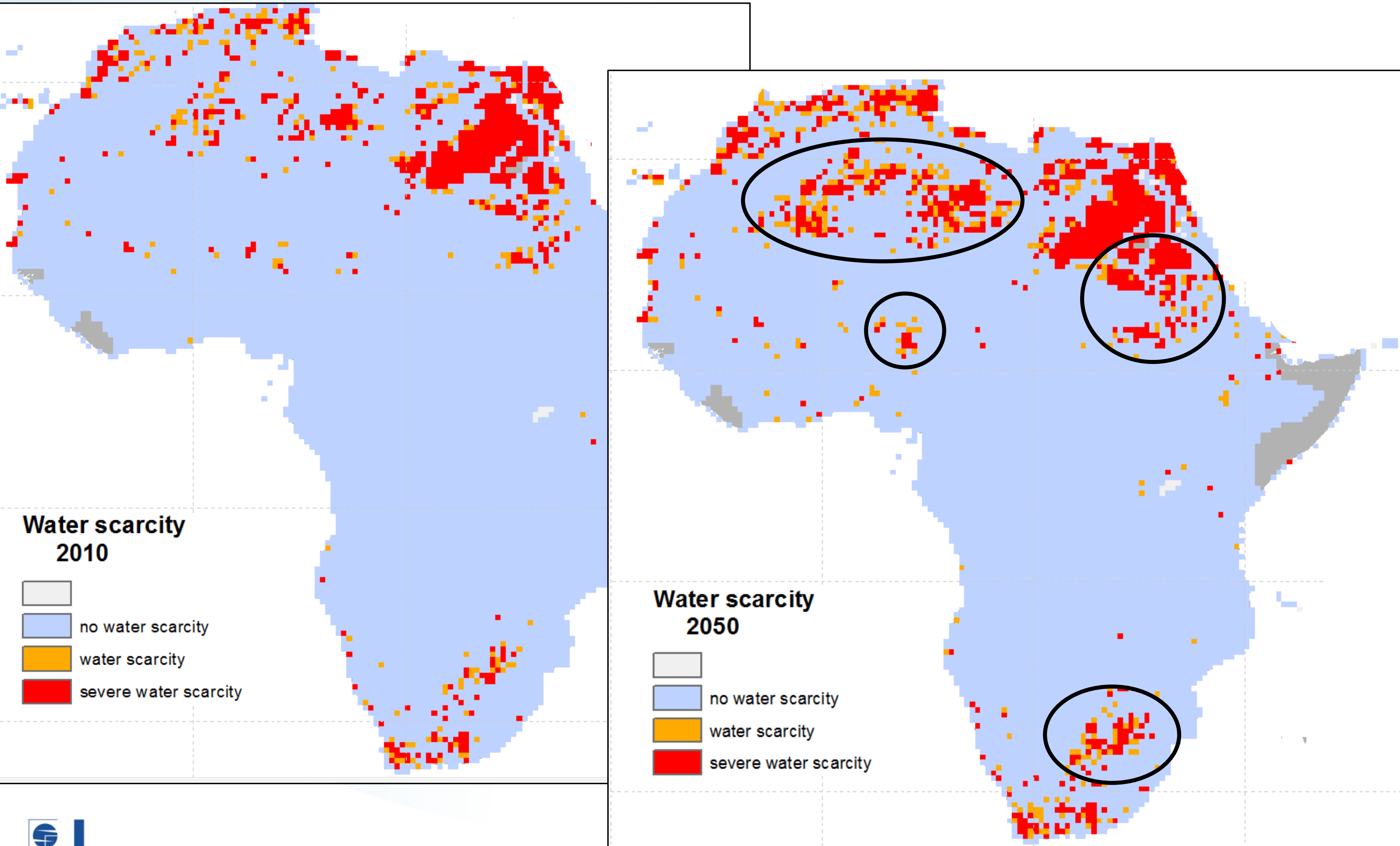


Change:

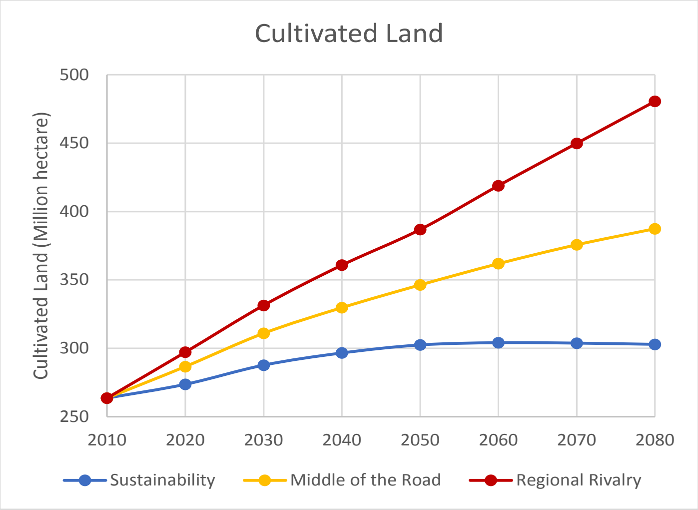
2010: 11% of total population or 105 -108 m people

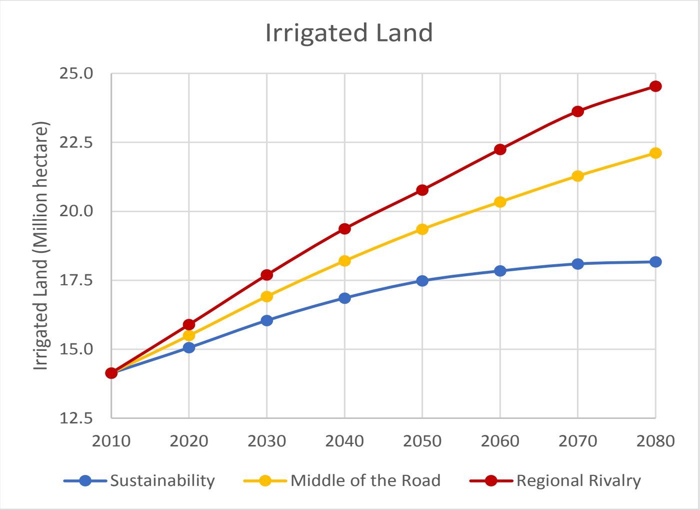
2050: 12% or 220 - 280 m people

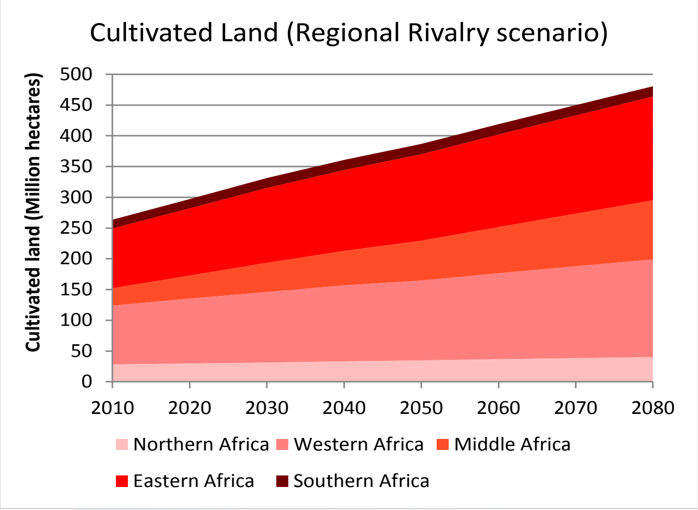
Water scarcity
Imbalance between supply and demand

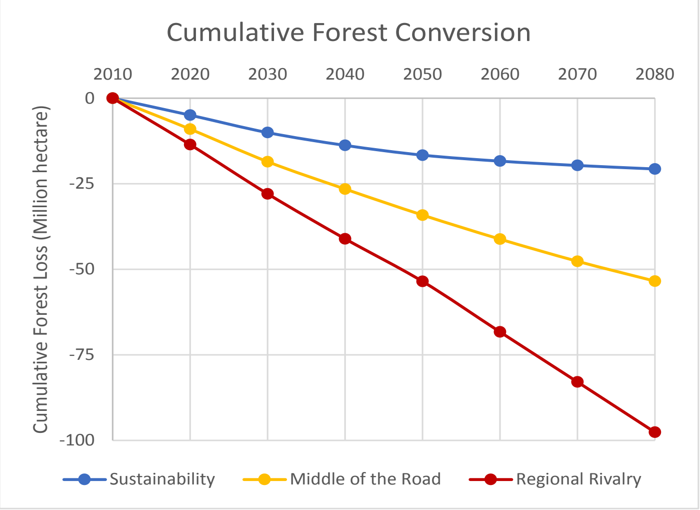


Changes in cultivated land – Africa







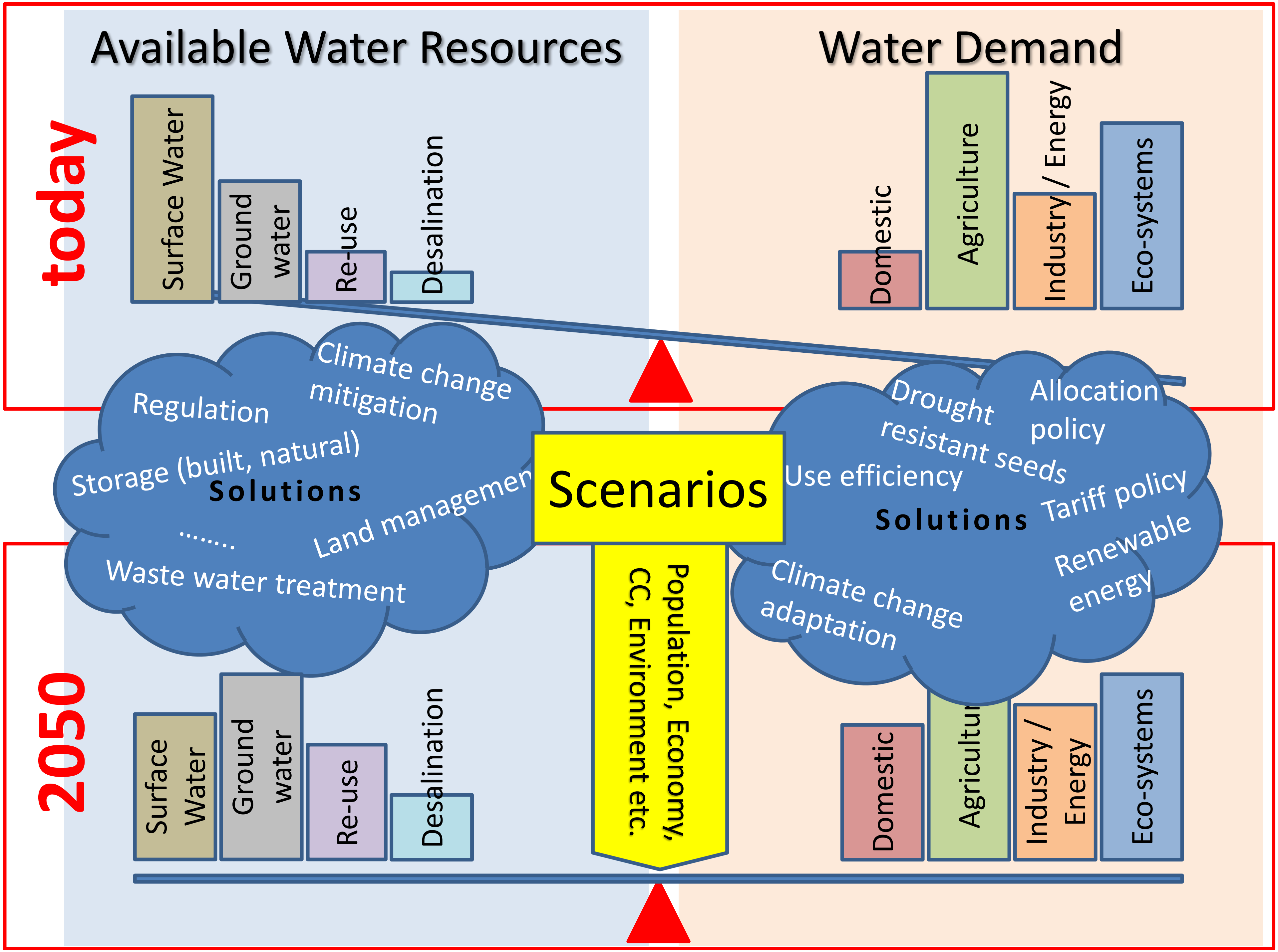


- Cultivate land will increase by 20-50% till 2050
- Irrigated land will increase by 25-40% till 2050
- African cropland expansion is likely to come with significant deforestation (20-54 m hectares by 2050)

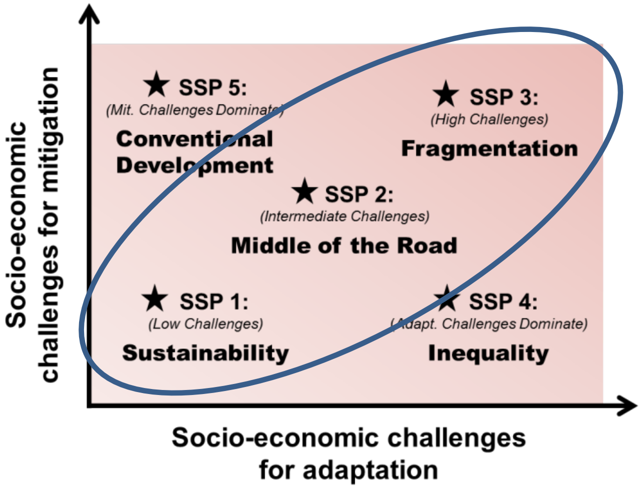
Water Futures and Solutions (WFaS) Initiative

Towards Innovative Solutions through Integrative Water Futures Analysis

United Nations Educational, Scientific and Cultural Organization
IIASA
The Ministry of Land, Infrastructure and Transport
IWA International Water Association
World Water Council
Austrian Development Cooperation
ADB
WaterFutures 4theWorld.


Available Water Resources
Water Demand
today
Surface Water
Ground water
Re-use
Desalination
Domestic
Agriculture
Industry / Energy
Eco-systems
Climate change mitigation
Regulation
Storage (built, natural)
Solutions
Land management
....
Waste water treatment
Scenarios
Drought resistant seeds
Allocation policy
Use efficiency
Tariff policy
Solutions
Renewable energy
Climate change adaptation
Population, Economy, CC, Environment etc.
2050
Surface Water
Ground water
Re-use
Desalination
Domestic
Agricultu
Industry / Energy
Eco-systems

Water Futures: Scenarios & Quantitative Assumptions



SSP1: The world is moving toward sustainability

SSP characteristics

- Improved resource use efficiency
- More stringent environmental regulations
- Rapid technological change is directed toward environmentally friendly processes
- Management of global commons improves.

Implications for Manufacturing Water Use:

- Manufacturing industries with efficient water use and low environmental impacts are favored.
- Enhanced treatment, reuse of water, and water-saving technologies;
- Widespread application of water-saving technologies in industry

Table 3 Qualitative technological changes on water use intensities in the domestic and industry sectors according to HE-regions.

			L		M		H		M	
		socio-economic capacity	poor		rich		Rich		Poor	
		hydro-climatic complexity	low		low		high		high	
			HE-1		**HE-2**		**HE-3**		**HE-4**	
[illegible]	**SSP1**	Sustainability Quest (SSP dominant)	HL	B	HM	B	HH	A	HM	B
M	**SSP2**	Business as Usual (SSP as HE)	ML	D	MM	C	MH	B	MM	C
L	**SSP3**	Fragmentation (HE dominant)	LL	E	LM	D	LH	C	LM	D

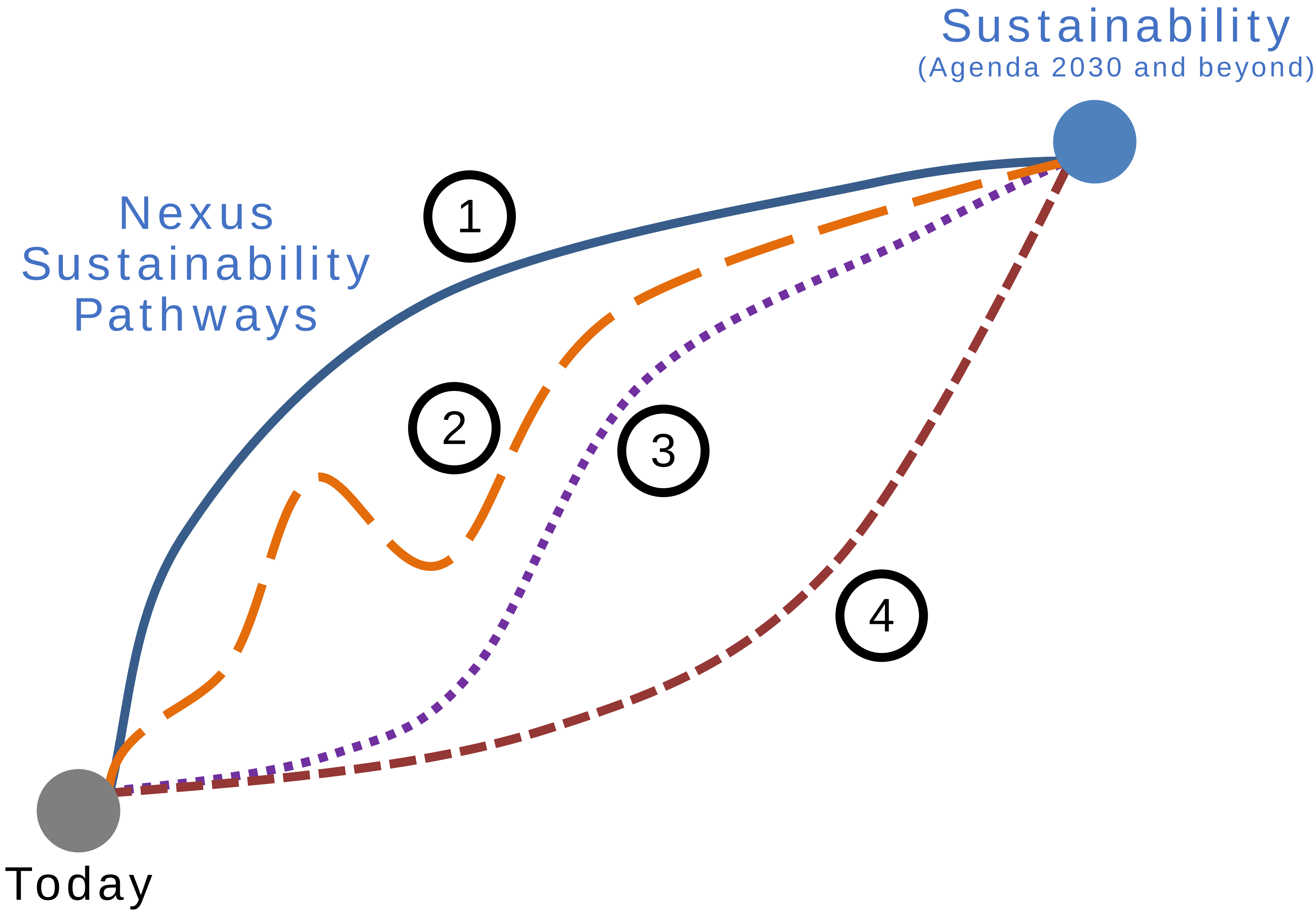
Table 4 Applied annual efficiency change rates as derived for different classes.

A	B	C	D	E
1.2%	1.1%	1%	0.6%	0.3%

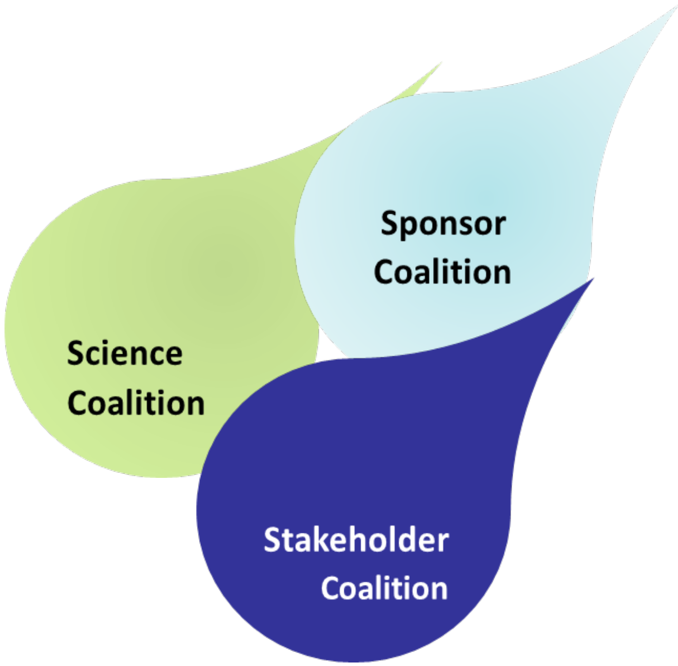
highest lowest

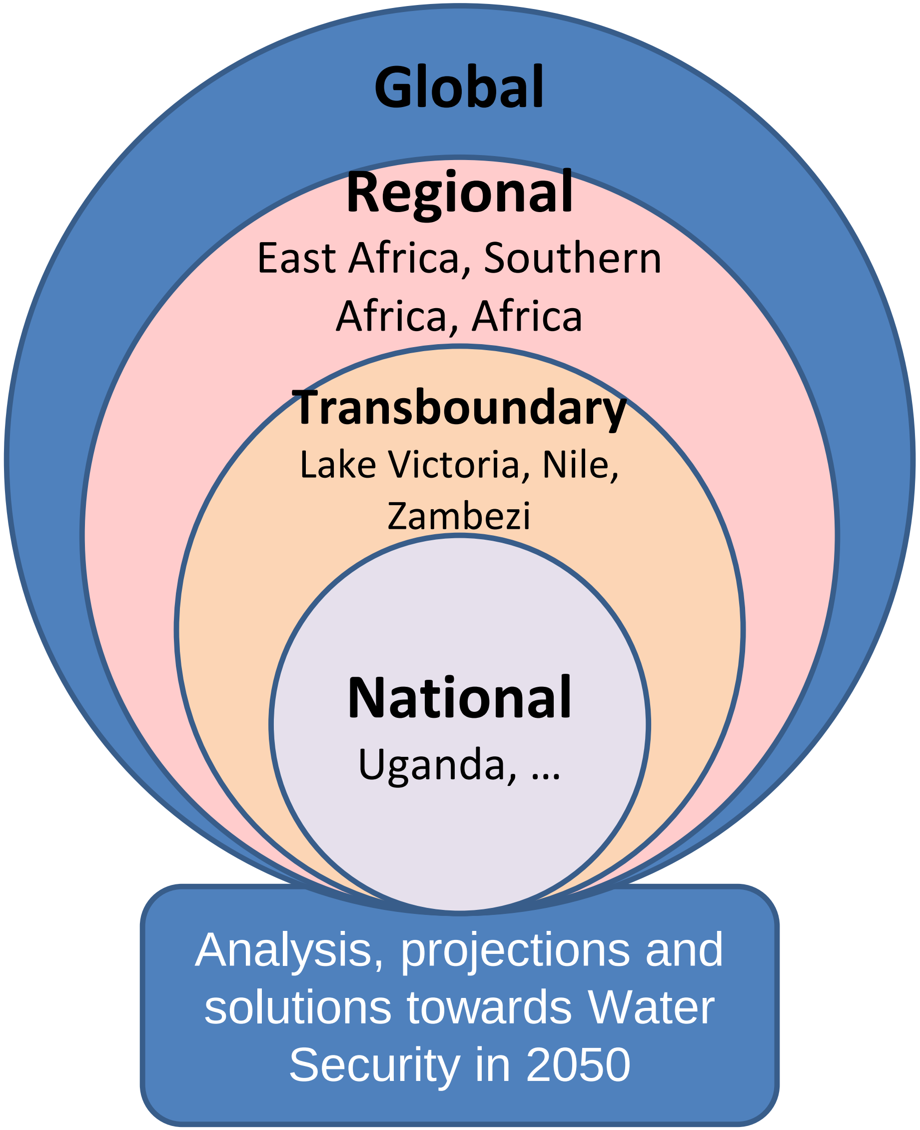
water futures and solutions

Why to engage stakeholders and experts?

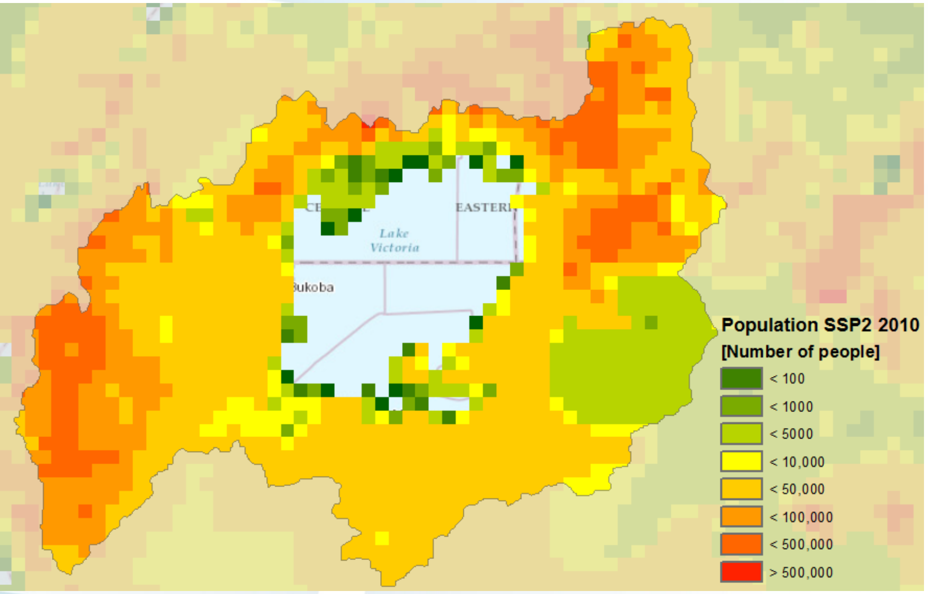


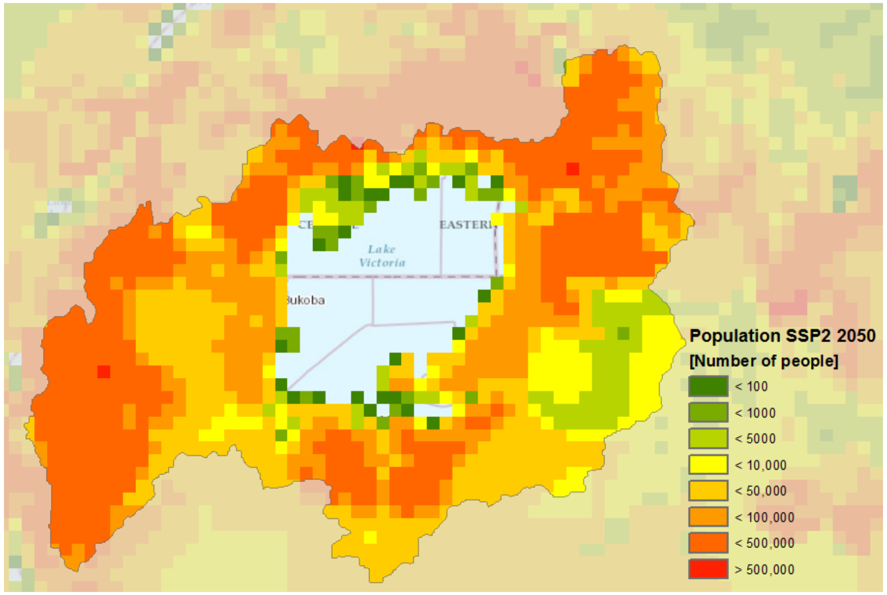
Nested Approach: four tiers
(case Africa)

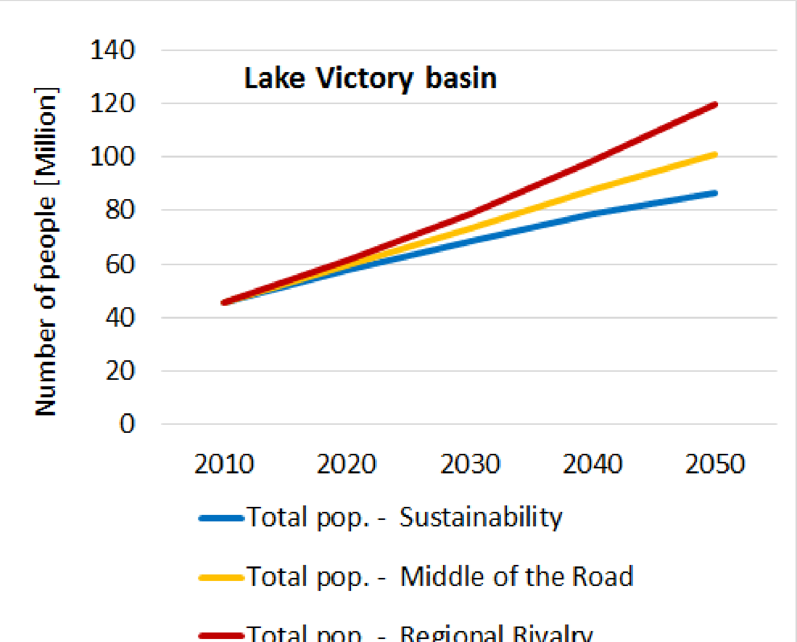




Socio-economic change -Population







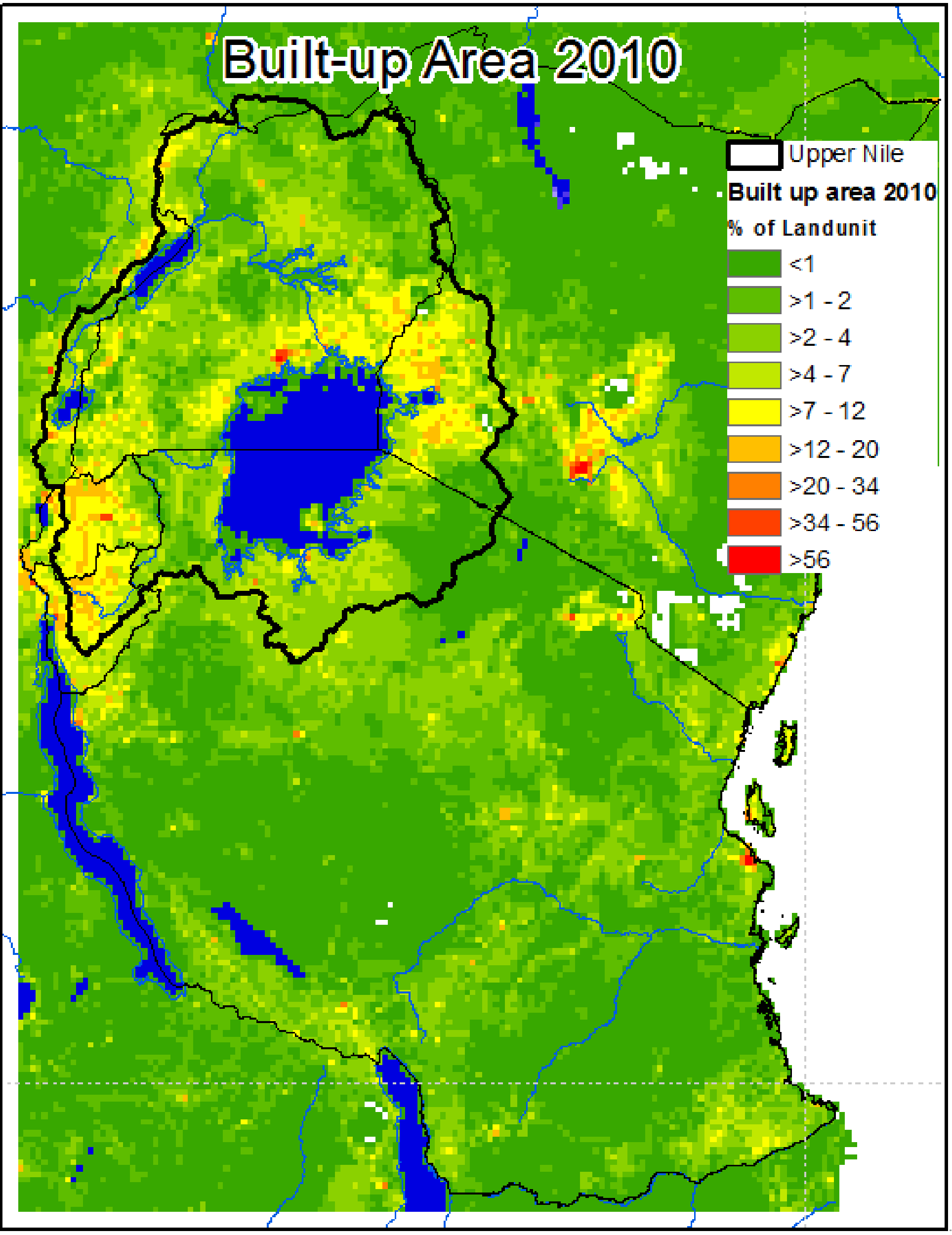
Lake Victoria basin

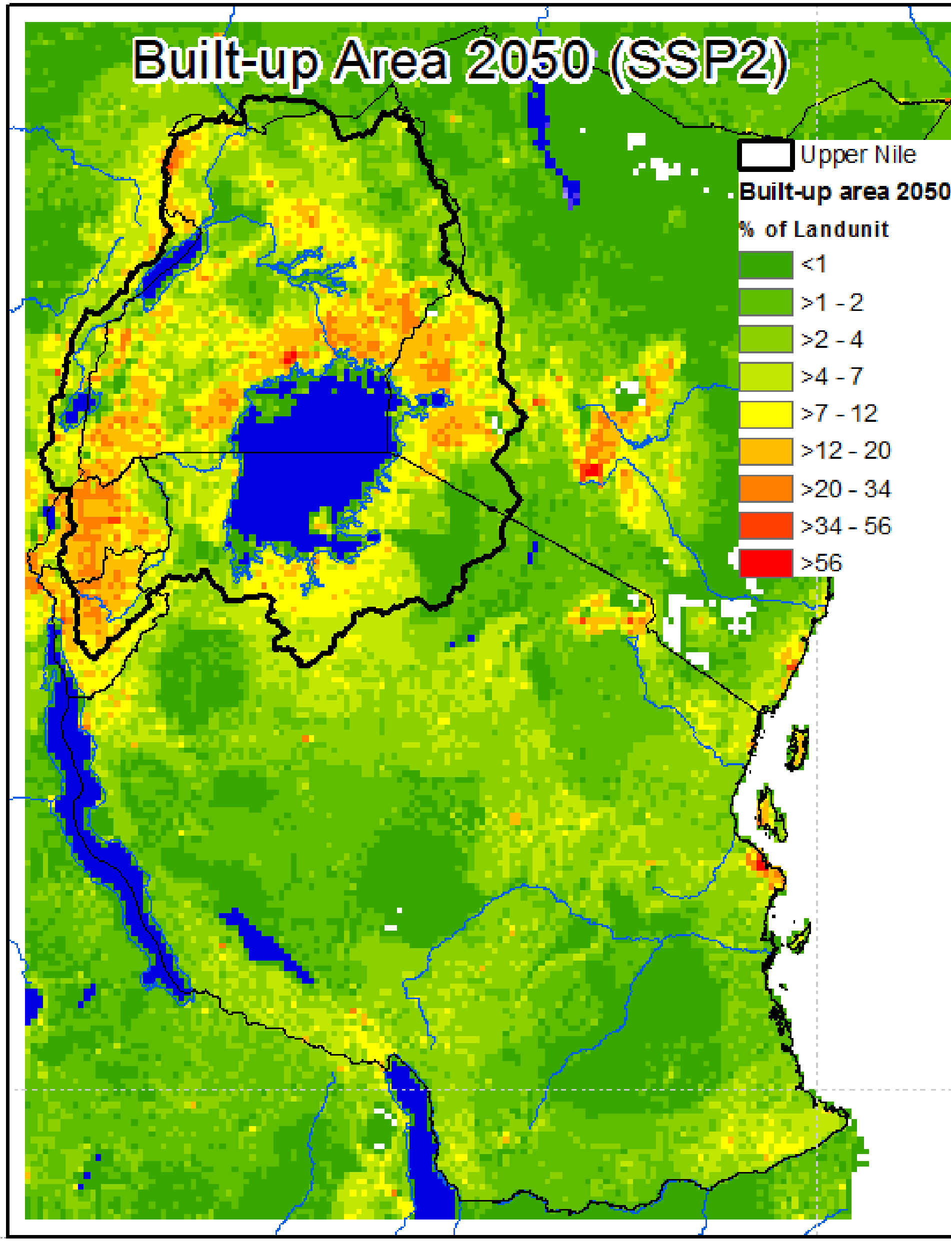
From 46 Mio. people in 2010 to 87 – 120 Mio. people in 2050 (+ 90% - 260% depending on scenario)

LVBC Strategy 2016 - 2021:

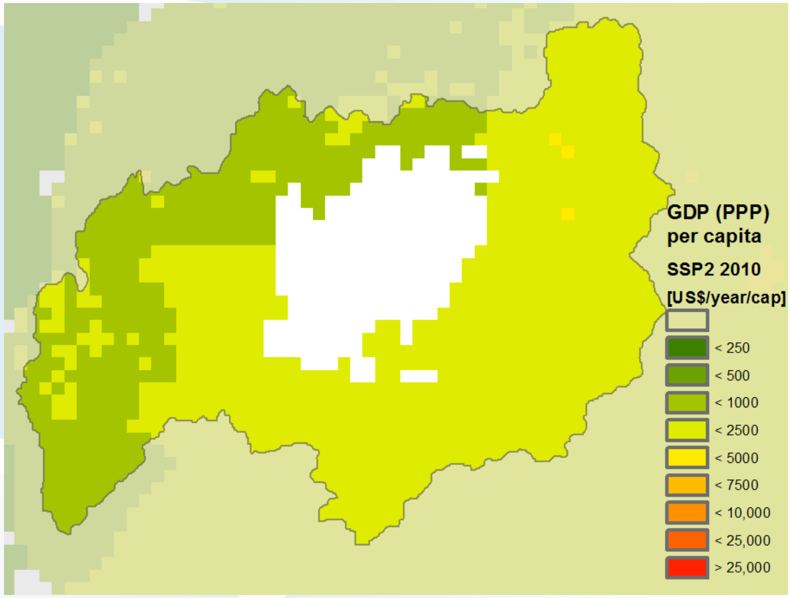
From 44,9 m people in 2015 to 59.5 m people in 2025

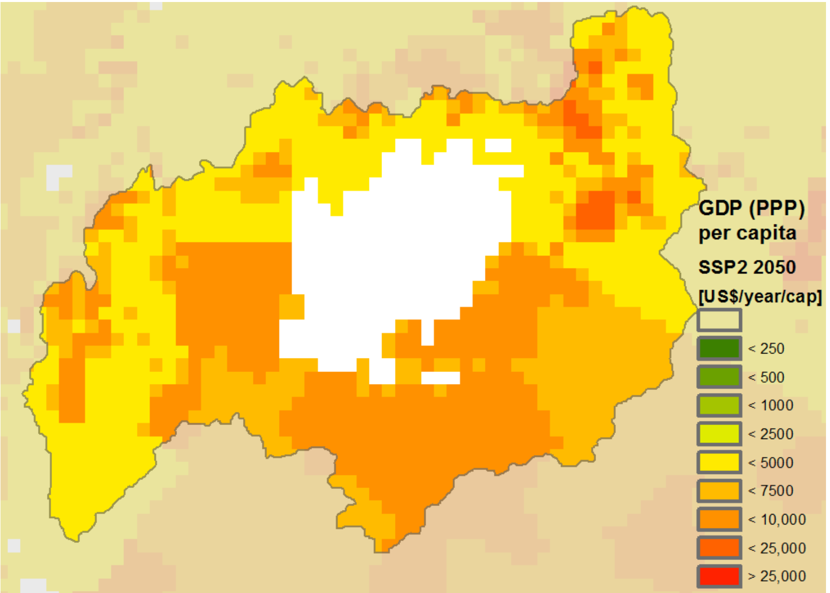
Change in built-up area in EAC

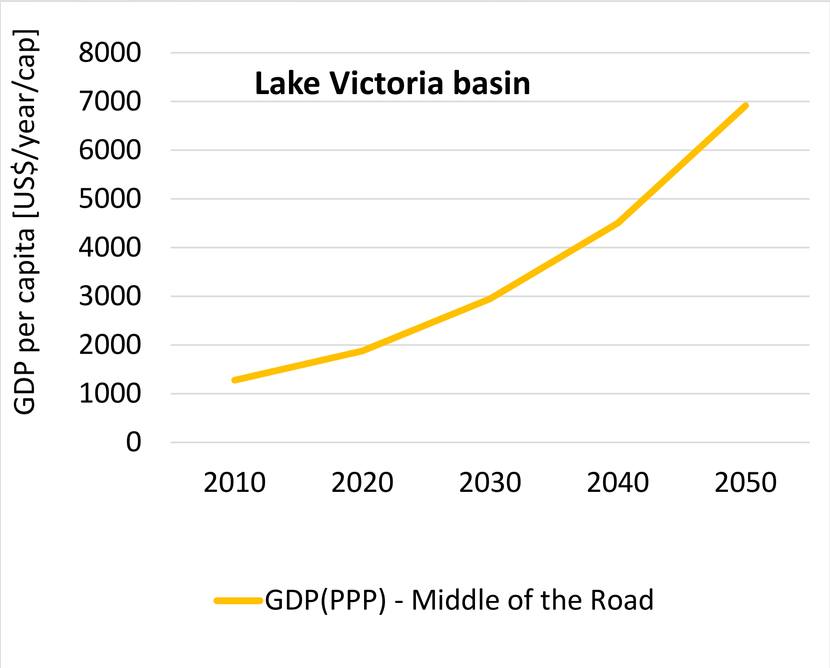




Socio-economic change - GDP







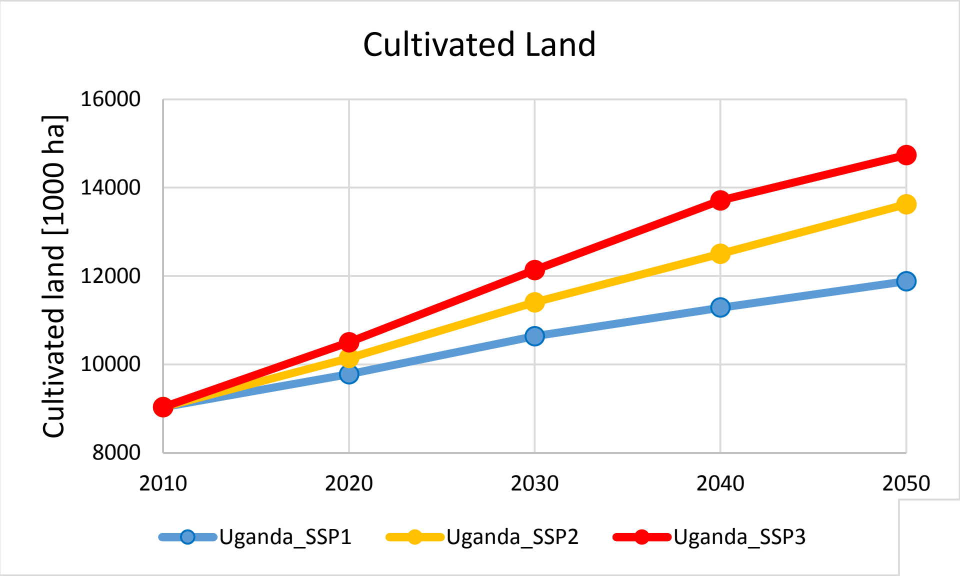
Middle of the Road scenario:

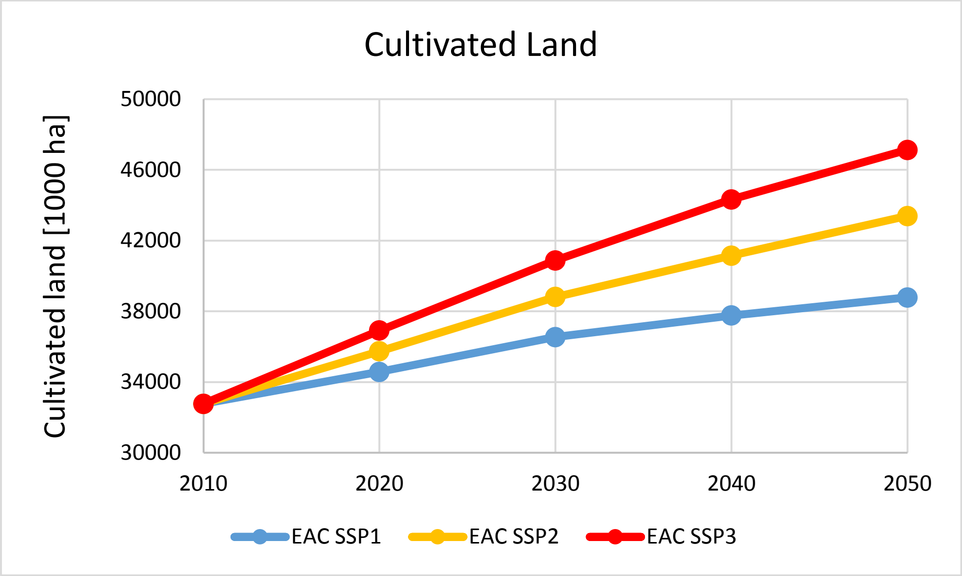
From 1,275 US$/year/cap in 2010 to 6,900 US$/year/cap in 2050 (+550%!)

EAC Vision 2050:

From 1,014 US$/year/cap in 2014 to 10,000 US$/year/cap in 2050

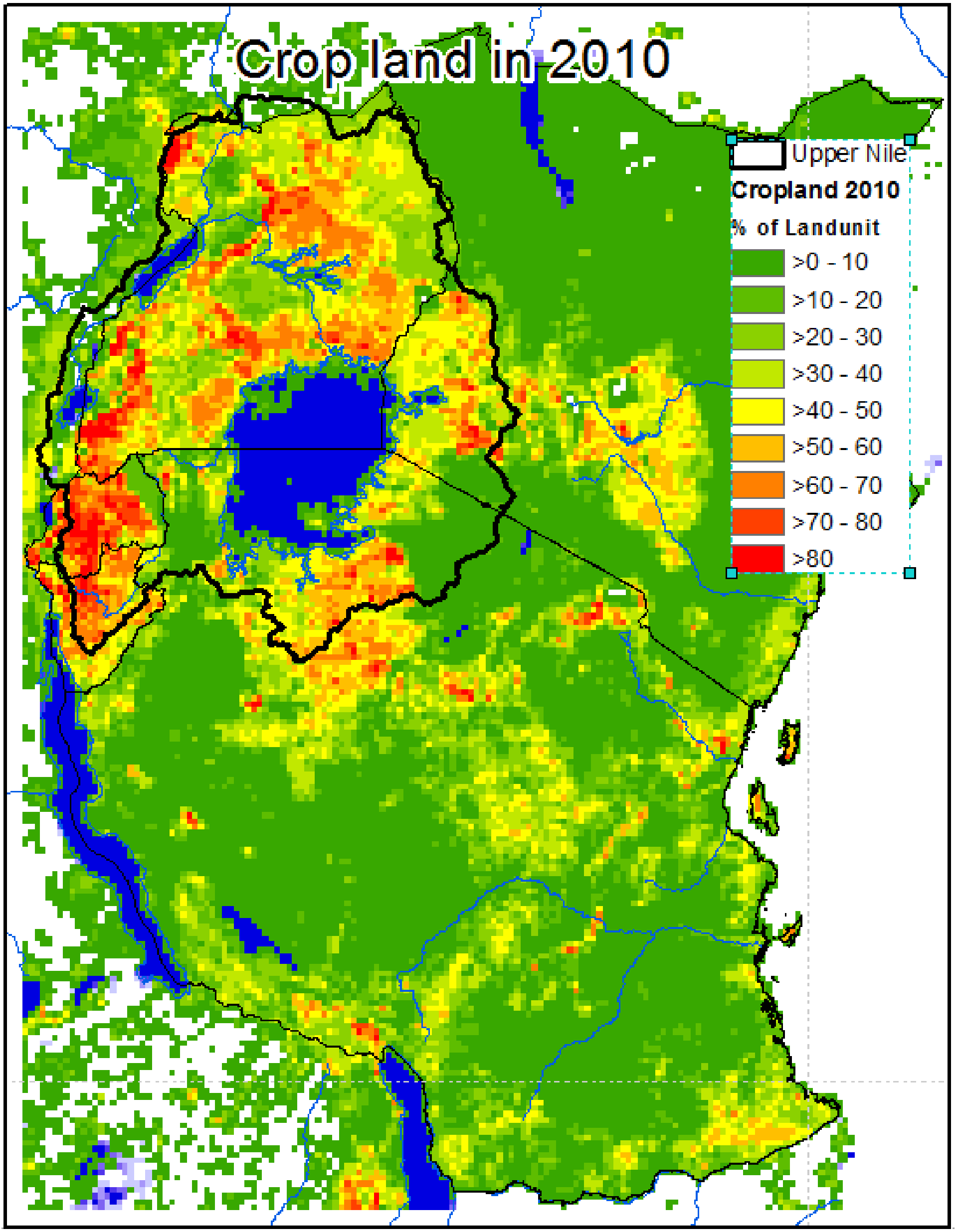
Change in cultivated land Uganda & EAC

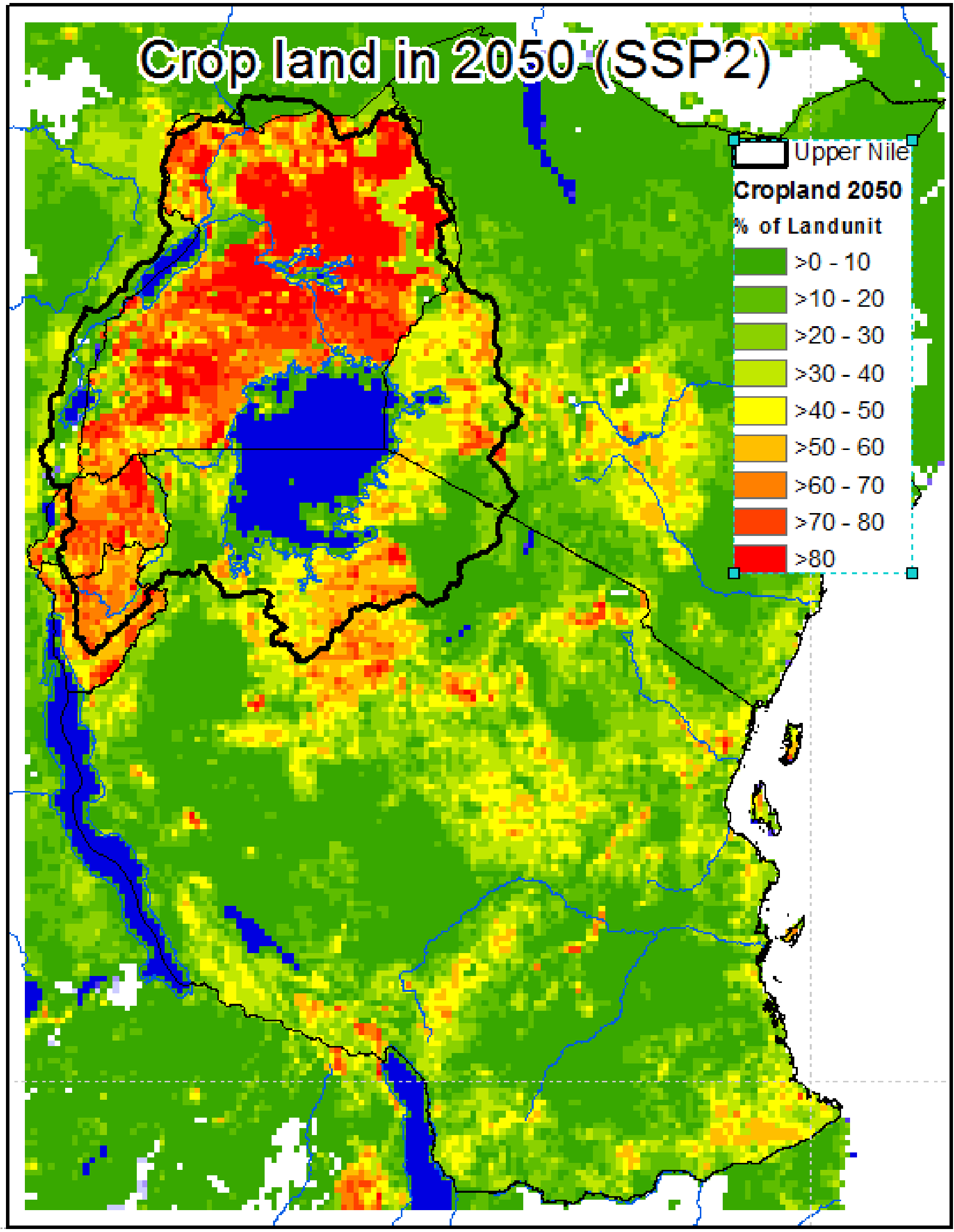




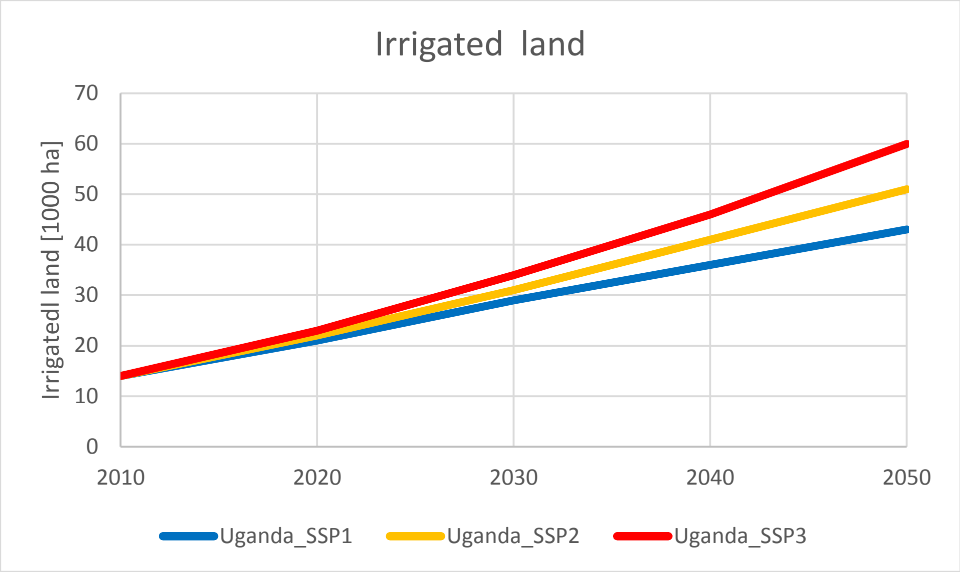
- Cultivate land will increase by 30-60% till 2050 for Uganda
- Cultivate land will increase by 20-40% till 2050 for EAC

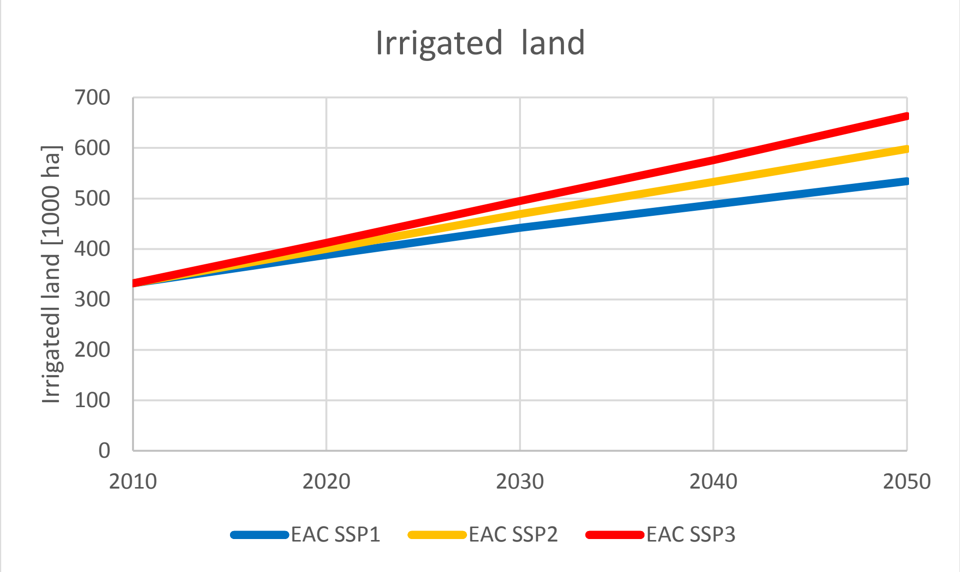
Change cultivated land area in EAC





Change in irrigated land





Target based on different strategy documents:

Uganda Vision 2040 / National WR Strategy:

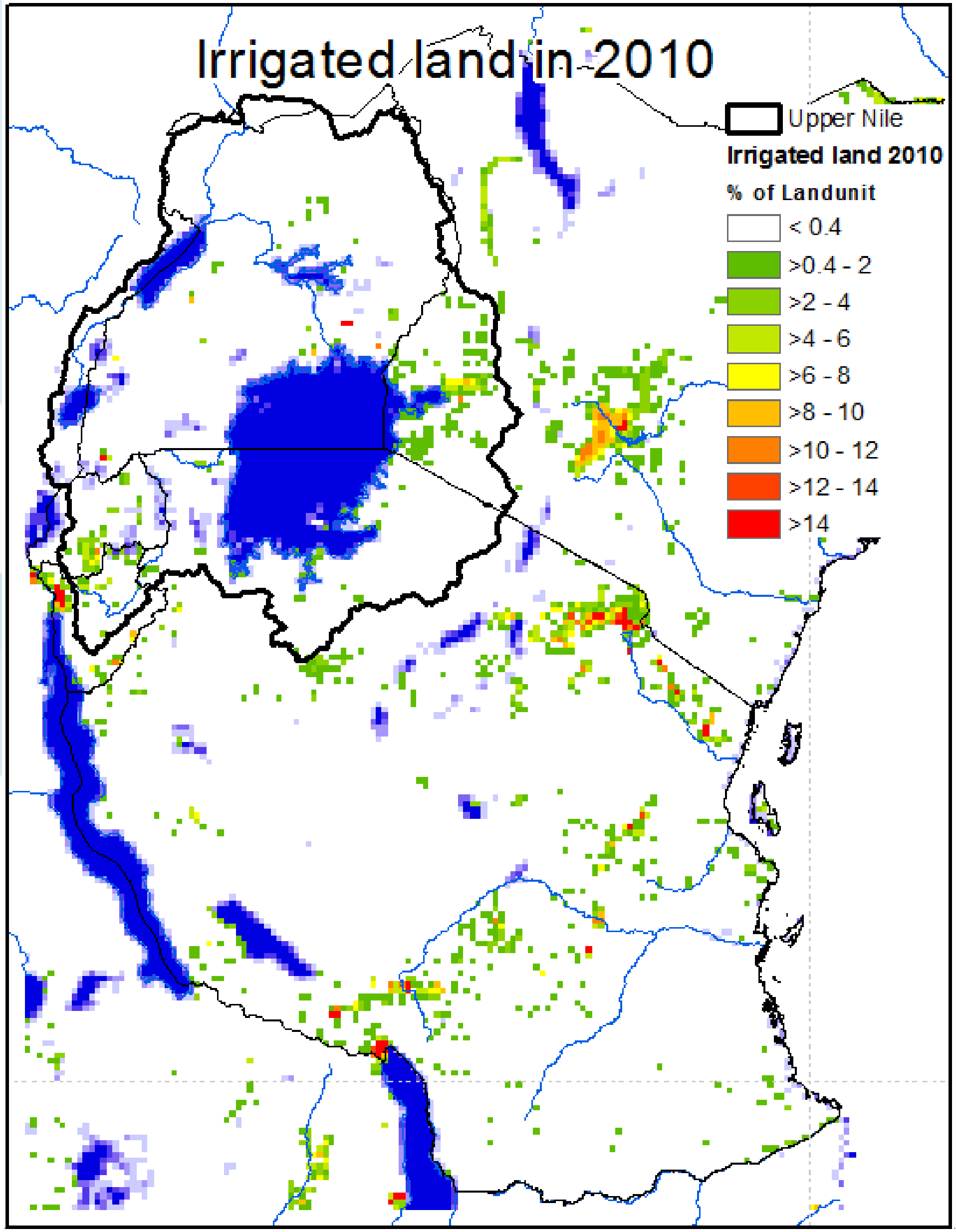
- more than 10 fold (>600.000 ha wetland und upland irrigation combined)

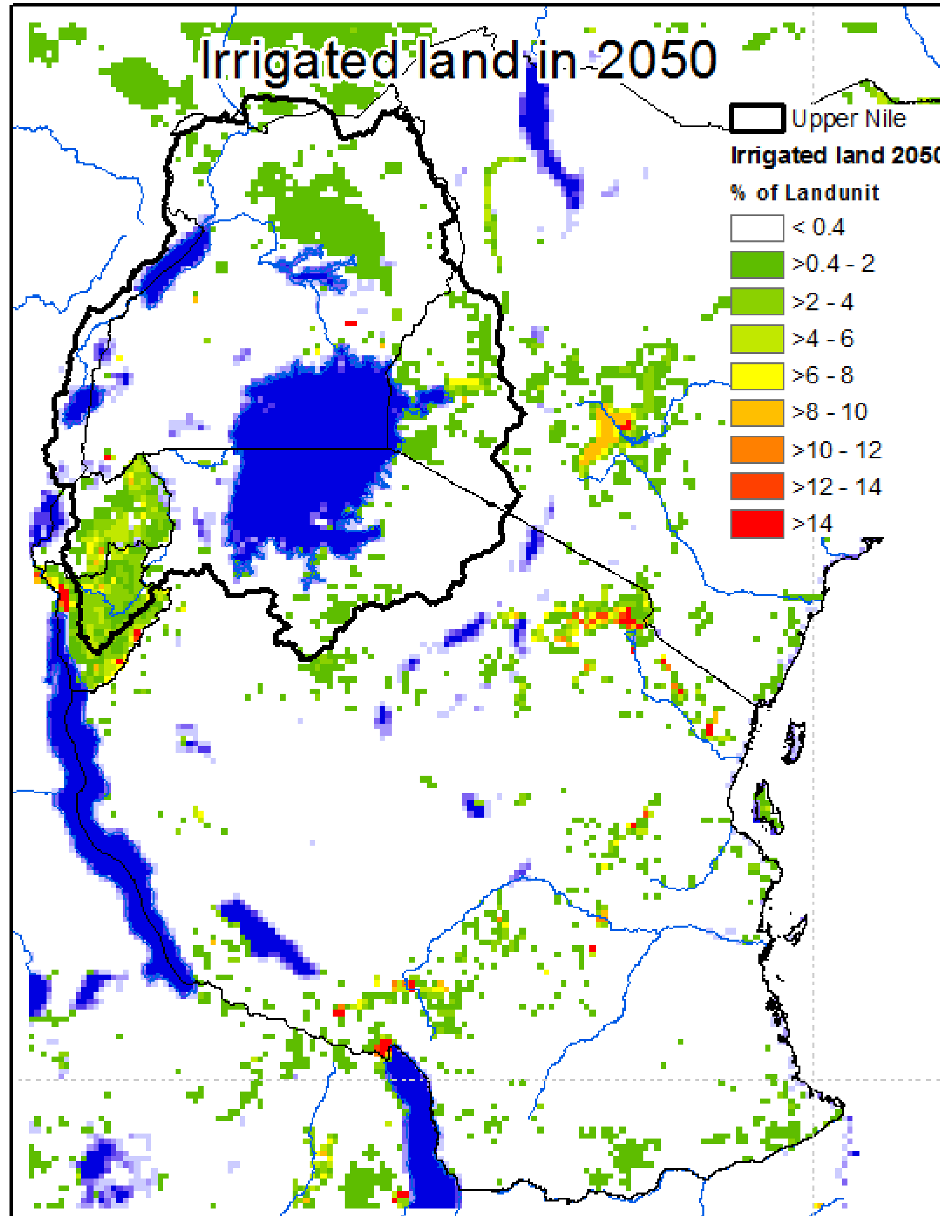
AMCOW Pan-African M&E System:

- Increase the size of irrigated areas by 100% from 2000 to 2025.
- Increase water productivity from irrigation and rainfed agriculture by 60% from 2000 to 2025

- Irrigated land will increase by 300-430% till 2050 for Uganda
- Irrigated land will increase by 60-200% till 2050 for EAC

Change irrigated land area in EAC





Water security and pathways to SOLUTIONS

- Water security depends on inter-relation of **water resources availability** (biophysical supply), societal and environmental **water demand**, and the potential to put dynamic **response options** in place.

- Water security **results** from a combination of both
  i) hydro-climatic challenges
  ii) socio-economic coping capacity

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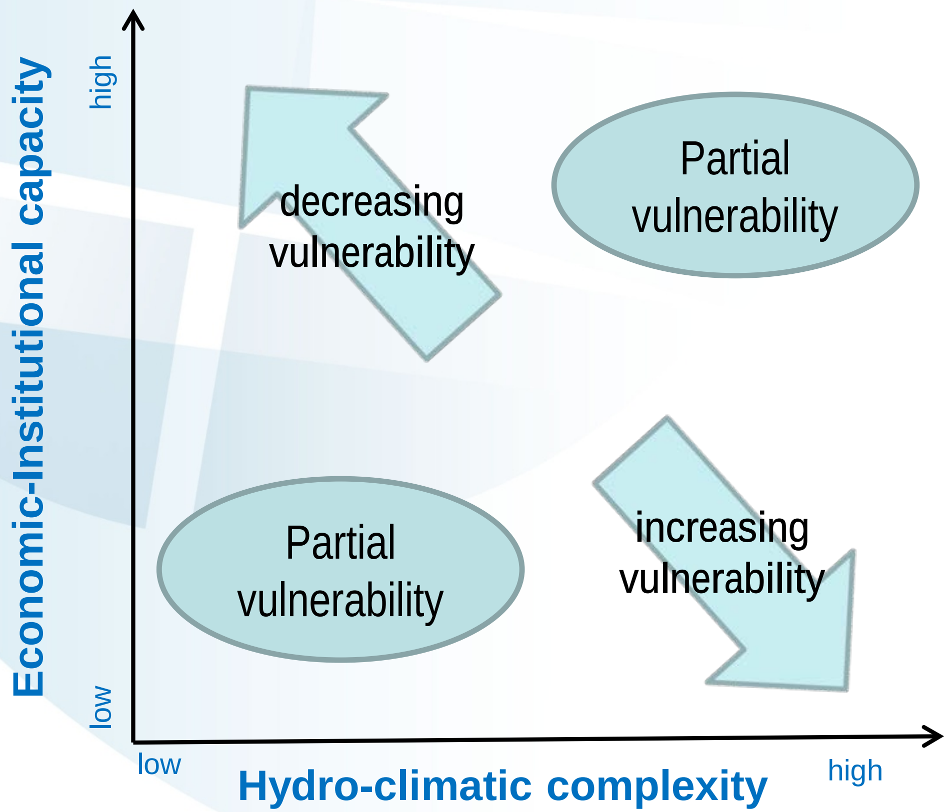
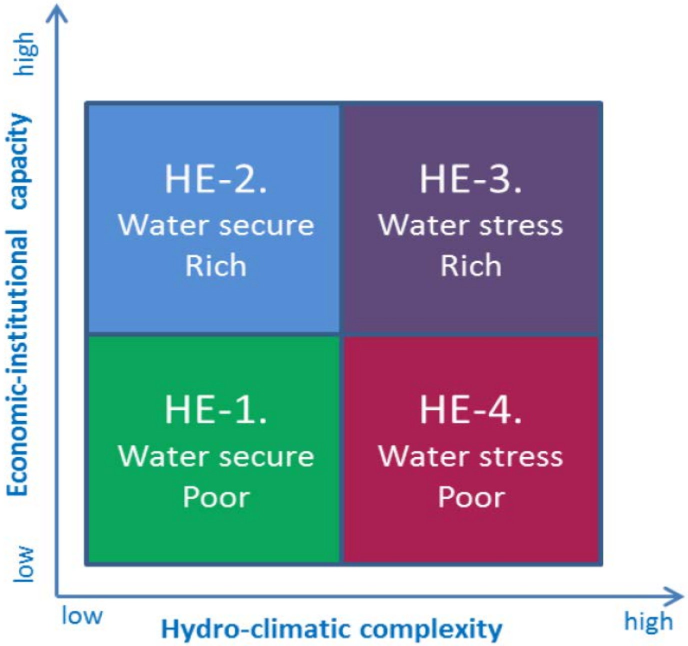
Hydro-Economic Classification

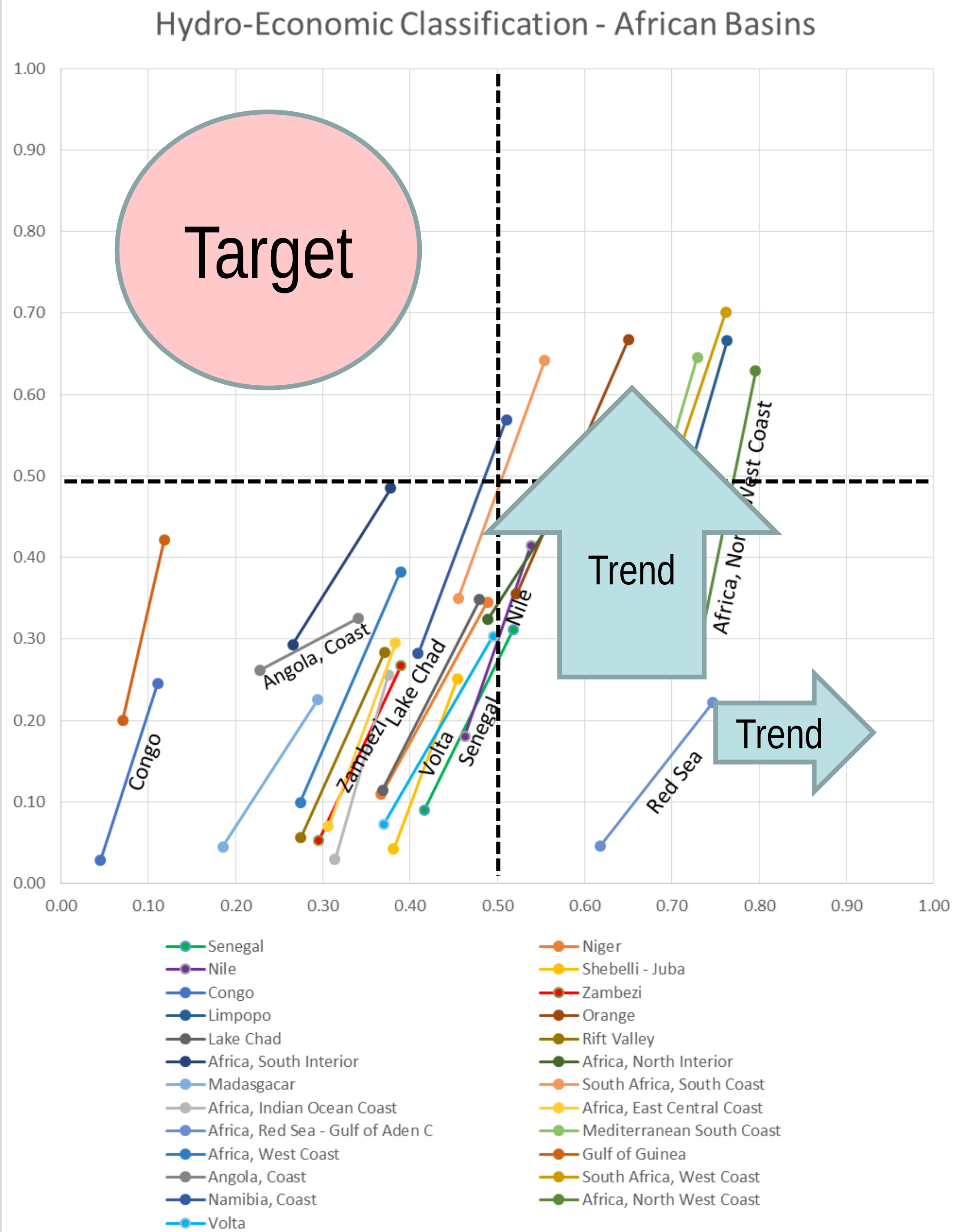
defines a risk-based approach towards water security



Economic-Institutional Capacity (Y-axes)
→ Coping capacity & Adaptation potential

Hydro-climatic complexity (X-axes)
→ Degree & type of water related challenges


HE-2.
Water secure
Rich
HE-3.
Water stress
Rich
HE-1.
Water secure
Poor
HE-4.
Water stress
Poor
Economic-institutional capacity
low
high
Hydro-climatic complexity
low
high


Hydro-Economic Classification - African Basins
Target
Trend
Trend
Congo
Angola, Coast
Lake Chad
Zambezi
Volta
Senegal
Nile
Red Sea
Africa, North West Coast
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Senegal
Nile
Congo
Limpopo
Lake Chad
Africa, South Interior
Madasgacar
Africa, Indian Ocean Coast
Africa, Red Sea - Gulf of Aden C
Africa, West Coast
Angola, Coast
Namibia, Coast
Volta
Niger
Shebelli - Juba
Zambezi
Orange
Rift Valley
Africa, North Interior
South Africa, South Coast
Africa, East Central Coast
Mediterranean South Coast
Gulf of Guinea
South Africa, West Coast
Africa, North West Coast

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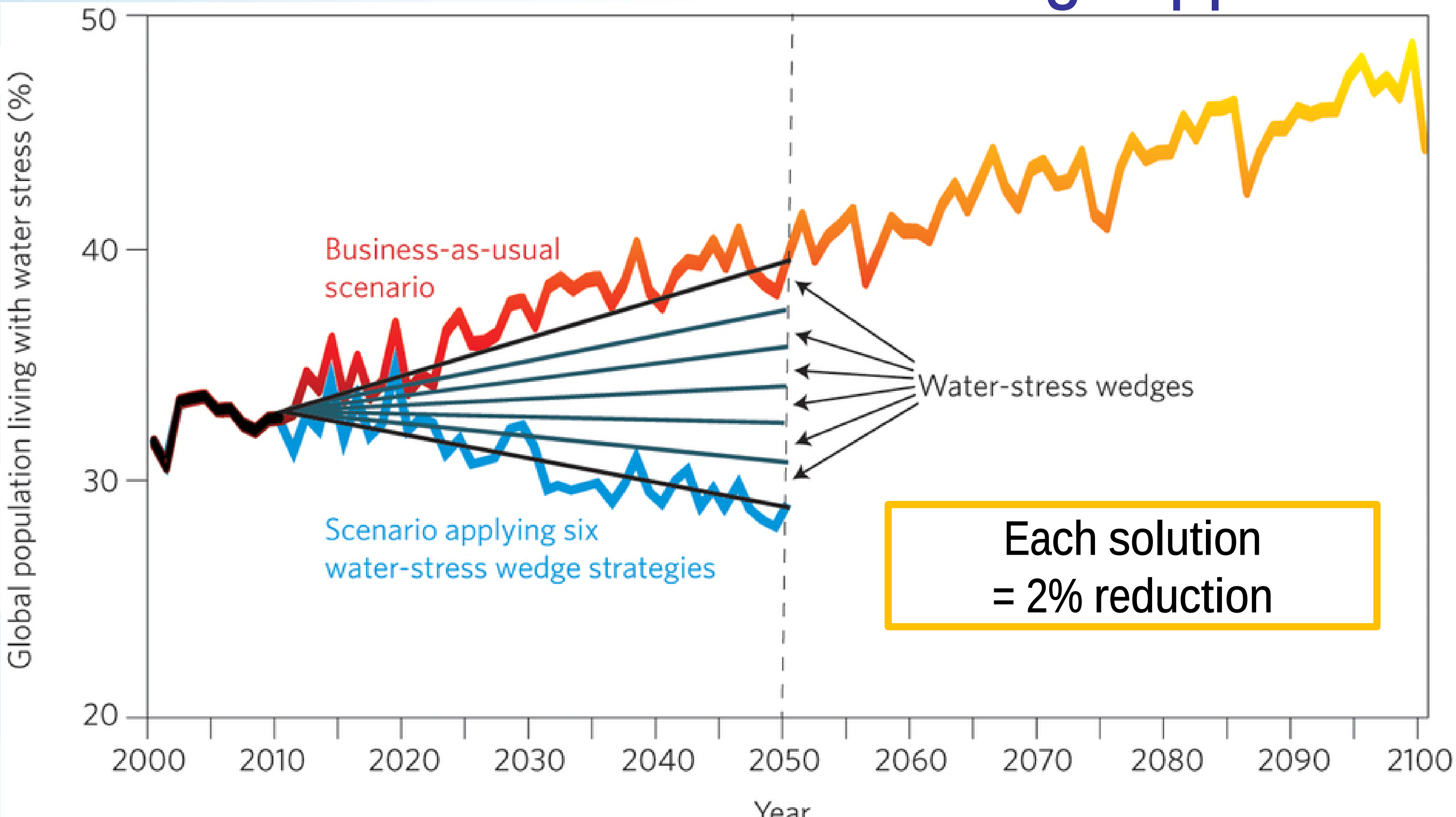
Solutions to water stress: Wedge approach



We present six strategies, or water-stress wedges, that collectively lead to a reduction in the population affected by water stress by 2050, despite an increasing population.

- **Water productivity – crop per drop**
- **Irrigation efficiency – decrease losses**
- **Water use intensity – industry and domestic**
- **Population**
- **Reservoir storage**
- **Desalination**

Soft path vs. Hard path

Wada et al. (2014), Nature Geoscience

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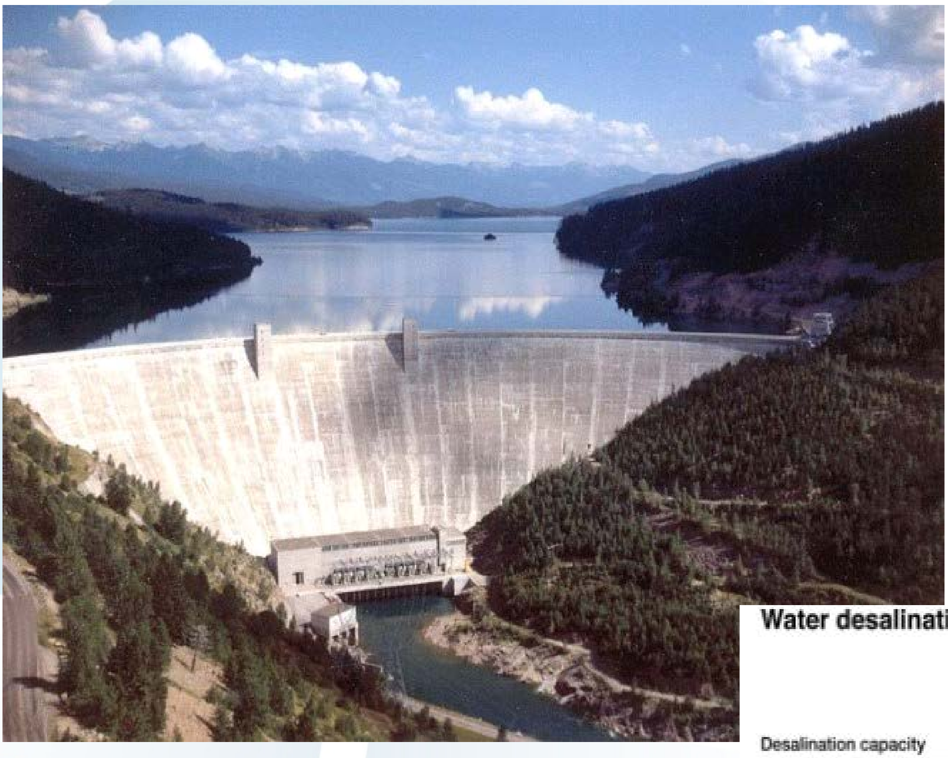
More Crop Per Drop

Improvement in water productivity at 0.5% per year (20% by 2050)

Efficiency increase by 1% per year (40% by 2050)

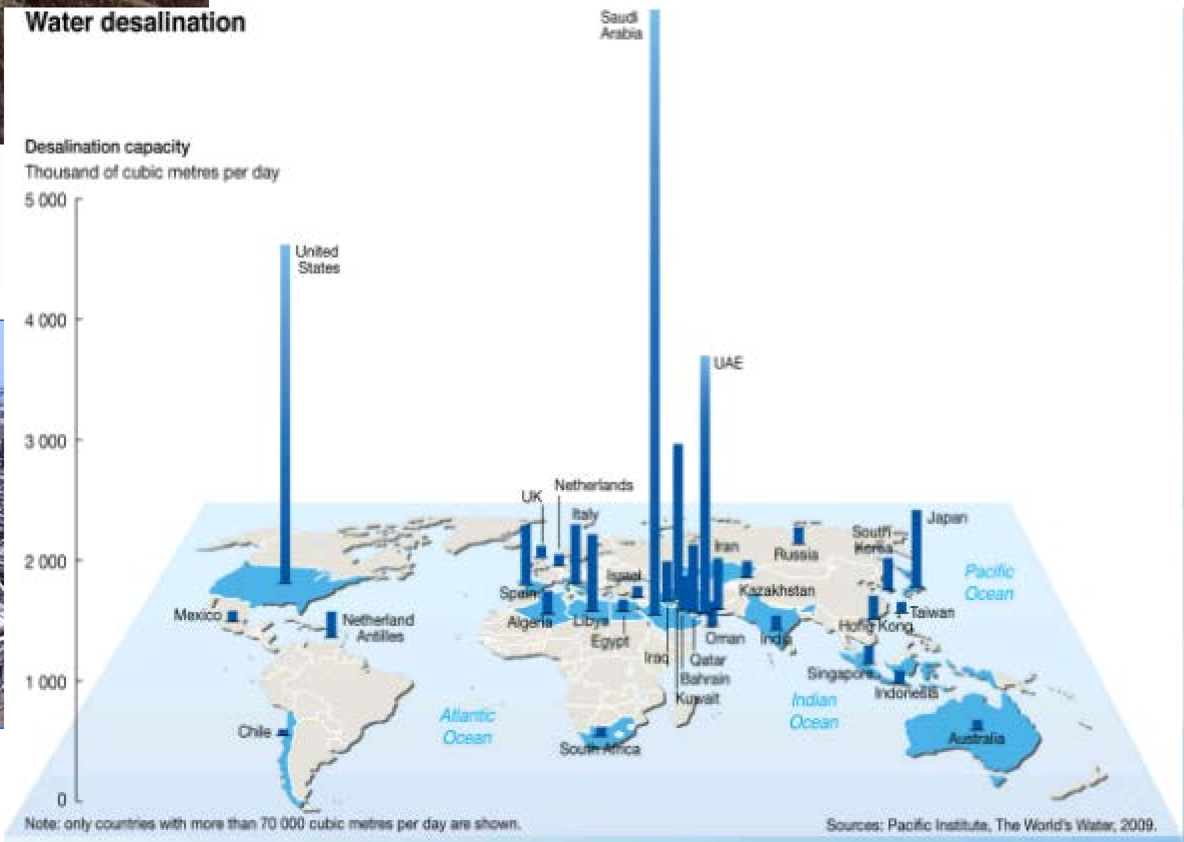
Improvement of 0.5% per year (20% by total)

Limit population growth by 0.5 billion (8.5 billion by 2050)



Additional 600 km^3 reservoir storage
(by 2050)
US$ 10 billion??

50 times increase in desalination capacity
(by 2050)
US$ 20 billion??



From science to policy and practice

What for do we model hydrological processes and relating them to socio-economic developments and the environment?

- Building evidence base for solid policy, sustainable water management and investment decisions.
- Understanding synergies and trade-offs between sectors (users) and riparian countries.
- “water proofing” future development pathways and future solution options

Why to engage?

- Linking science with practitioners:
  Modelling based on robust but ambitious scenarios
- Co-create: thinking through possible development and solutions pathways and
- Co-design the models
- Benefit from robust water scenarios to support your decision making for SDG fit water resources planning in your water basin
- Deepening / strengthening capacities through partnerships

- Contact: wfas.info@iiasa.ac.at

  http://www.iiasa.ac.at/web/home/research/researchPrograms/water/waterhome.html